CLAIMS

We claim:

1. A case hardening apparatus for case hardening a work piece, said case hardening apparatus comprising:

a ring of conductive material having an inner diameter, and outer diameter, and opposing planar sides;

a first dielectric material fixed to one of said planar sides; and

a second dielectric material fixed to the other of said planar sides.

2. The case hardening apparatus as in claim 1, in which said first dielectric material is formed as an integral part of a cooling jacket adjacent to said one of said planar sides.

3. The case hardening apparatus as in claim 1, in which said second dielectric material is formed as an integral part of a quenching ring adjacent to said other of said planar sides.

4. The case hardening apparatus as in claim 1, in which said first and second dielectric materials are the same material.

5. The case hardening apparatus as in claim 1, in which said conductive material is a metal.

6. The case hardening apparatus as in claim 1, in which a plurality of conductive teeth extend radially from at least one of said inner diameter and said outer diameter of said ring.

7. The case hardening apparatus as in claim 6, in which at least one slot formed in said conductive material extends radially toward a tip of one of said teeth.

8. The case hardening apparatus as in claim 6, in which said plurality of conductive teeth extend radially inwardly from said inner diameter of said ring, and at least one slot formed in said conductive material extends radially inwardly from said outer diameter toward a tip of one of said teeth.

9. The case hardening apparatus as in claim 6, in which a vertex is formed between adjacent conductive teeth, and conductive material is removed from said ring proximal vertex to prevent overheating gear teeth of the work piece being hardened.

10. The case hardening apparatus as in claim 1, in which said conductive material is less than 0.25 inches thick.

11. A case hardening apparatus for case hardening a work piece, said case hardening apparatus comprising:

a ring of conductive material having an inner diameter, an outer diameter, and opposing planar sides;

a plurality of conductive teeth extending radially from at least one of said inner diameter and said outer diameter, wherein a vertex is formed between adjacent conductive teeth, and conductive material is removed from said ring proximal said vertex to prevent overheating gear teeth of the work piece being hardened.

12. The case hardening apparatus as in claim 11, in which said first dielectric material is formed as an integral part of a cooling jacket adjacent to said one of said planar sides.

13. The case hardening apparatus as in claim 11, in which said second dielectric material is formed as an integral part of a quenching ring adjacent to said other of said planar sides.

14. The case hardening apparatus as in claim 11, in which said first and second dielectric materials are the same material.

15. The case hardening apparatus as in claim 11, in which said conductive material is a metal.

16. The case hardening apparatus as in claim 11, in which at least one slot formed in said conductive material extends radially toward a tip of one of said teeth.

17. The case hardening apparatus as in claim 11, in which said plurality of conductive teeth extend radially inwardly from said inner diameter of said ring, and at least one slot formed in said conductive material extends radially inwardly from said outer diameter toward a tip of one of said teeth.

18. The case hardening apparatus as in claim 11, in which said conductive material is less than 0.25 inches thick.

19. A case hardening apparatus for case hardening a work piece, said case hardening apparatus comprising:

a ring of conductive material having an inner diameter, an outer diameter, and opposing planar sides;

a plurality of conductive teeth extending radially from at least one of said inner diameter and said outer diameter; and

at least one slot formed in said conductive material extending radially toward a tip of one of said teeth.

20. The case hardening apparatus as in claim 19, in which a first dielectric material is formed as an integral part of a cooling jacket adjacent to said one of said planar sides.

21. The case hardening apparatus as in claim 19, in which a second dielectric material is formed as an integral part of a quenching ring adjacent to said other of said planar sides.

22. The case hardening apparatus as in claim 19, in which said conductive material is a metal.

23. The case hardening apparatus as in claim 19, in which a vertex is formed between adjacent conductive teeth, and conductive material is removed from said ring proximal said vertex to prevent overheating gear teeth of the work piece being hardened.

24. The case hardening apparatus as in claim 19, in which said conductive material is less than 0.25 inches thick.

25. The case hardening apparatus as in claim 19, in which said plurality of conductive teeth extend radially inwardly from said inner diameter of said ring, and at least one slot formed in said conductive material extends radially inwardly from said outer diameter toward a tip of one of said teeth.

26. A method for case hardening a gear, said method comprising:

cutting gear teeth within tolerances that are tighter than that required of a finished gear;

inductively heating said gear teeth;

cooling said gear teeth to form the finished gear having a hardened case with a predetermined depth and hardness; and

using the finished gear without further machining said gear teeth.

27. The method as in claim 26, in which inductively heating said gear teeth includes moving one of said gear and an inductive ring relative to the other of said gear and said inductive ring at a predetermined rate.

28. The method as in claim 27, in which said inductive ring includes opposing planar sides, and a first dielectric material fixed to one of said planar sides and a second dielectric material fixed to the other of said planar sides.

29. The method as in claim 28, in which said first dielectric material is formed as an integral part of a cooling jacket adjacent to said one of said planar sides.

30. The method as in claim 28, in which said second dielectric material is formed as an integral part of a quenching ring adjacent to said other of said planar sides, and cooling said gear teeth including spraying coolant from said quenching ring onto said gear teeth.

31. The method as in claim 27, in which said inductive ring is formed from a conductive material and includes an inner diameter and an outer diameter, and a plurality of conductive teeth extend radially from at least one of said inner diameter and said outer diameter of said ring.

32. The method as in claim 31, in which at least one slot formed in said conductive material extends radially toward a tip of one of said teeth.

33. The method as in claim 31, in which said plurality of conductive teeth extend radially inwardly from said inner diameter of said ring, and at least one slot formed in said conductive material extends radially inwardly from said outer diameter toward a tip of one of said teeth.

34. The method as in claim 31, in which a vertex is formed between adjacent conductive teeth, and conductive material is removed from said ring proximal vertex to prevent overheating said gear teeth while inductively heating said gear teeth.

35. The method as in claim 31, in which said conductive material is less than 0.25 inches thick.

36. The method as in claim 26 including shot-peening specific surfaces of the gear.

37. The method as in claim 26 in which using the finished gear includes shipping the finished gear to an end user.